SONY

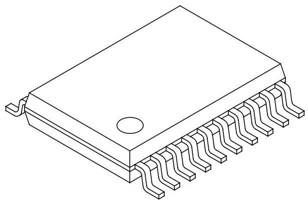
CXA3225N

All Band TV Tuner IC (VHF-CATV-UHF)

Description

The CXA3225N is a TV tuner monolithic IC which integrates local oscillator and mixer circuits for VHF band, local oscillator and mixer circuits for UHF band, and an IF amplifier onto a single chip. This IC adopts a 20-pin SSOP package and is suitable for miniaturizing voltage synthesizer tuner.

20 pin SSOP (Plastic)



Features

- Low power consumption (5 V, 46 mA typ.)
- Single 5 V power supply
- Superior cross modulation
- Balance-type UHF oscillator with good oscillation stability (4 pins)
- IF output can be selected from symmetrical or asymmetrical
- Double-tuned filter can be connected to MIX output
- SSOP 20-pin package

Applications

- TV tuners
- VCR tuners
- CATV tuners

Structure

Bipolar silicon monolithic IC

-Absolute Maximum Ratings (Ta=25 °C)

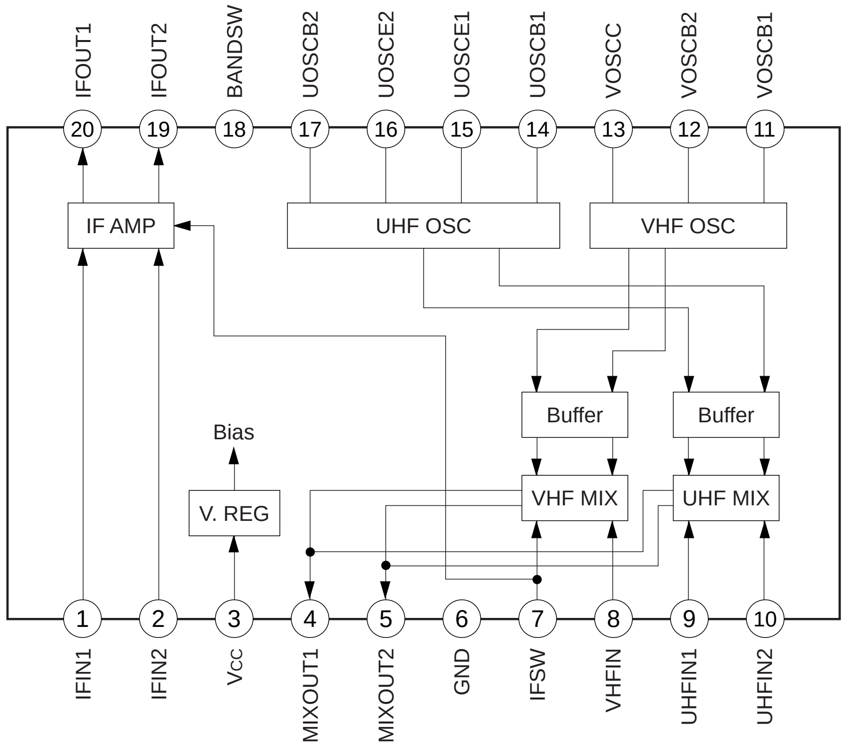
• Supply voltage	$V_{CC}1$	–0.3 to +5.5	V
• Storage temperature	Tstg	–55 to +150	°C
• Allowable power dissipation	P_D	465	mW

(when mounted on a printed circuit board)

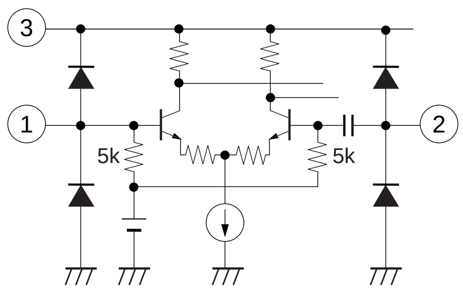
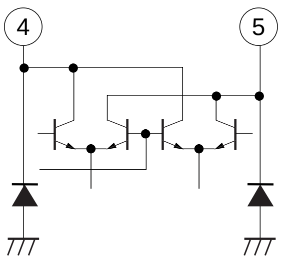
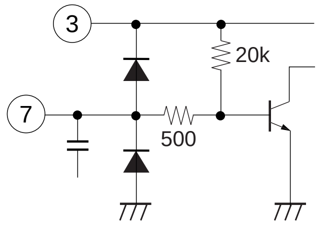
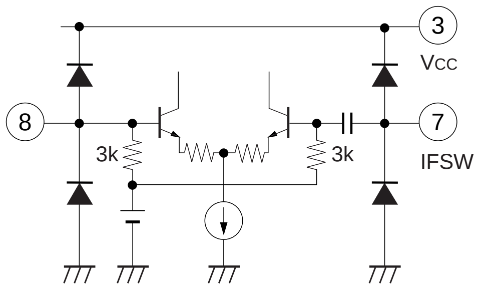
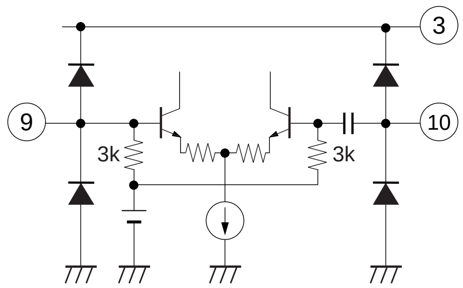
Operating Conditions

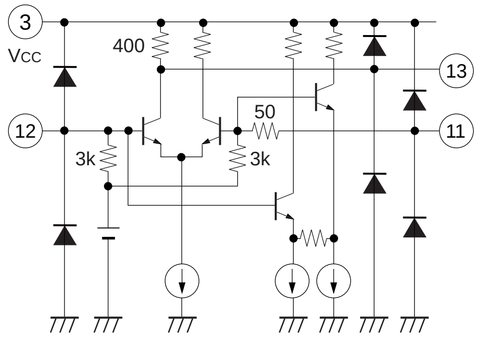
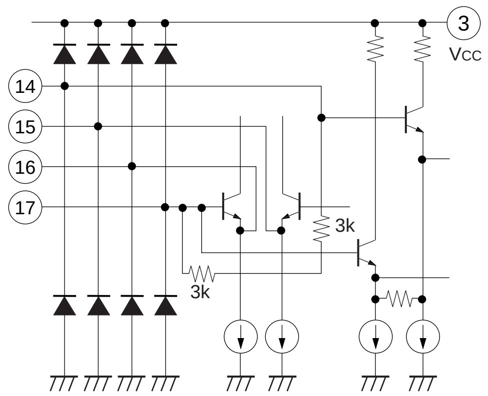
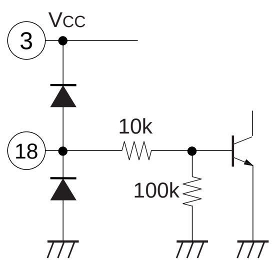
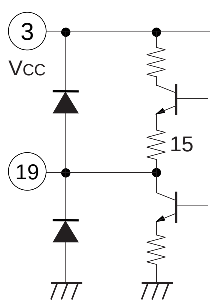
• Supply voltage	$V_{CC}1$	4.75 to 5.30	V
• Operating temperature	Topr	–20 to +75	°C

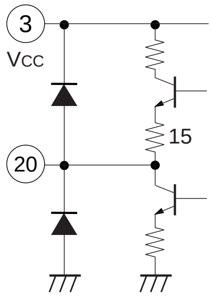
Block Diagram and Pin Configuration



Pin Description and Equivalent Circuit

Pin No.	Symbol	Typical pin voltage (V)	Equivalent circuit	Description
1	IFIN1	2.4		IF amplifier input.
2	IFIN2	2.4		
3	Vcc	5.0		Power supply.
4	MIXOUT1	4.4 during VHF reception 4.3 during UHF reception		Mixer outputs. These pins are output with open collector, and they must be connected to the power supply via the load.
5	MIXOUT2	4.4 during VHF reception 4.3 during UHF reception		
6	GND	0		GND.
7	IFSW	0.8 (when open)		Switching of VHF input ground and IF symmetrical/ asymmetrical output. Asymmetrical output is selected for open state; symmetrical output for grounding. When used as an asymmetrical output, ground this pin with a capacitor.
8	VHFIN	2.4 during VHF reception 2.6 during UHF reception		VHF inputs. Input format is asymmetrical input.
9	UHFIN1	2.6 during VHF reception 2.3 during UHF reception		UHF inputs. Input the signal to Pins 9 and 10 symmetrically or ground Pin 10 with a capacitor and input to Pin 9.
10	UHFIN2	2.6 during VHF reception 2.3 during UHF reception		

Pin No.	Symbol	Typical pin voltage (V)	Equivalent circuit	Description
11	VOSCB1	2.1 during VHF reception 2.2 during UHF reception		External resonance circuit connection for VHF oscillators. Pin 12 is grounded with a capacitor.
12	VOSCB2	2.1 during VHF reception 2.2 during UHF reception		
13	VOSCC	4.2 during VHF reception 5 during UHF reception		
14	UOSCB1	2.3 during VHF reception 2.1 during UHF reception		External resonance circuit connection for UHF oscillators.
15	UOSCE1	1.8 during VHF reception 1.5 during UHF reception		
16	UOSCE2	1.8 during VHF reception 1.4 during UHF reception		
17	UOSCB2	2.3 during VHF reception 2.1 during UHF reception		
18	BANDSW	—		Band switching. UHF operation for 3.0 V or more, and VHF operation for 0.5 V or less or open state.
19	IFOUT2	2.8 during symmetrical output 4.5 during asymmetrical output		IF output during symmetrical output. The opposite phase signal to Pin 20 is output during symmetrical output. When asymmetrical output is selected, the signal is not output.

Pin No.	Symbol	Typical pin voltage (V)	Equivalent circuit	Description
20	IFOUT1	2.8 during symmetrical output 2.8 during asymmetrical output		IF output.

Electrical Characteristics

See the Electrical Characteristics Measurement Circuit
($Ta=25$ °C, $V_{CC}=5$ V)

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Unit
Circuit current	$I_{CC}VU$	VHF operation asymmetrical output no input signal	35	46	55	mA
	$I_{CC}VB$	VHF operation symmetrical output no input signal	47	58	67	mA
	$I_{CC}UU$	UHF operation asymmetrical output no input signal	39	50	59	mA
	$I_{CC}UB$	UHF operation symmetrical output no input signal	51	62	71	mA
Conversion gain *1	CG1U	VHF operation f_{RF}=50 MHz asymmetrical output	20	23	26	dB
	CG2U	VHF operation f_{RF}=430 MHz asymmetrical output	20	23	26	dB
	CG3U	UHF operation f_{RF}=430 MHz asymmetrical output	23	26	29	dB
	CG4U	UHF operation f_{RF}=850 MHz asymmetrical output	23	26	29	dB
	CG1B *4	VHF operation f_{RF}=50 MHz symmetrical output	29	32	35	dB
	CG2B *4	VHF operation f_{RF}=430 MHz symmetrical output	29	32	35	dB
	CG3B *4	UHF operation f_{RF}=430 MHz symmetrical output	32	35	38	dB
	CG4B *4	UHF operation f_{RF}=850 MHz symmetrical output	32	35	38	dB
Noise figure *1, *2	NF1	VHF operation f_{RF}=50 MHz asymmetrical output		12	16	dB
	NF2	VHF operation f_{RF}=430 MHz asymmetrical output		13	17	dB
	NF3	UHF operation f_{RF}=430 MHz asymmetrical output		10	13	dB
	NF4	UHF operation f_{RF}=850 MHz asymmetrical output		12	15	dB
1 % cross modulation *1 *3	CM1	VHF operation f_D=50 MHz f_{UD}=±12 MHz asymmetrical output	99	103		dBμ
	CM2	VHF operation f_D=430 MHz f_{UD}=±12 MHz asymmetrical output	96	100		dBμ
	CM3	UHF operation f_D=430 MHz f_{UD}=±12 MHz asymmetrical output	96	100		dBμ
	CM4	UHF operation f_D=850 MHz f_{UD}=±12 MHz asymmetrical output	95	99		dBμ
Maximum output power	Pomax (sat)	50 Ω load, asymmetrical output	7	10		dBm
Switch ON drift	Δfsw1	VHF operation f_{OSC}=100 MHz Δf from 3 seconds to 3 minutes after switch ON			±300	kHz
	Δfsw2	VHF operation f_{OSC}=470 MHz Δf from 3 seconds to 3 minutes after switch ON			±600	kHz
	Δfsw3	UHF operation f_{OSC}=470 MHz Δf from 3 seconds to 3 minutes after switch ON			±350	kHz
	Δfsw4	UHF operation f_{OSC}=895 MHz Δf from 3 seconds to 3 minutes after switch ON			±350	kHz

*1 Value measured with untuned input.

*2 NF meter direct-reading value (DSB measurement).

*3 Value with a desired reception signal input level of –30 dBm, an interference signal of 100 kHz/30 % AM, and an interference signal level where S/I=46 dB measured with a spectrum analyzer.

*4 Value which is measured as 420 Ω load impedance and compensated loss by 180 Ω resistor connected to Pins 19 and 20.

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Unit
Supply voltage drift	$\Delta fst1$	VHF operation f_{OSC}=100 MHz Δf when V_{CC} 5 V ± 5 % variation			±200	kHz
	$\Delta fst2$	VHF operation f_{OSC}=470 MHz Δf when V_{CC} 5 V ± 5 % variation			±250	kHz
	$\Delta fst3$	UHF operation f_{OSC}=470 MHz Δf when V_{CC} 5 V ± 5 % variation			±150	kHz
	$\Delta fst4$	UHF operation f_{OSC}=895 MHz Δf when V_{CC} 5 V ± 5 % variation			±150	kHz
Band switching voltage	$V_{SW}V$	VHF operation	0		0.5	V
	$V_{SW}U$	UHF operation	3		5.5	V

Description of Operation

(See the Electrical Characteristics Measurement Circuit.)

VHF oscillator circuit

This circuit is a differential amplifier-type oscillator circuit. Pin 13 is the output, Pin 11 is the input and Pin 12 is the GND.
Oscillation is performed by connecting an LC resonance circuit including a variable capacitance diode, to Pin 13 via coupled capacitance, inputting to Pin 11 with feedback capacitance, and applying positive feedback.
Note that if the capacitance across Pins 11 and 13 is too large, positive feedback may be applied via a parasitic capacitance causing undesired stray oscillation. The resistor connected Pin 11 prevents the parasitic oscillation.

VHF mixer circuit

The mixer circuit employs a double balanced mixer with little local oscillation signal leakage. The input format is the base input type. Pin 7 is grounded and the RF signal is input to Pin 8. The RF signal is converted to IF frequency by the signal supplied from the oscillator and then output to Pins 4 and 5. Pins 4 and 5 are open collectors, so the power must be supplied externally. The electric potential of Pins 4 and 5 at this time must be DC 4.0 V or more.

UHF oscillator circuit

This oscillator circuit is designed so that two collector ground type Colpitts oscillators perform the differential oscillation operation via an LC resonance circuit including a variable capacitance diode. The resonance capacitors which configure the Colppits oscillator are connected between Pins 14 and 15, 15 and 16, 16 and 17.
The LC resonance circuit including the variable capacitance diode Di is connected between Pins 14 and 17.

UHF mixer circuit

This circuit employs a double balanced mixer like the VHF mixer circuit. The RF signal is input to Pins 9 and 10. There are two input methods; one is the symmetrical input where the signal is input to Pins 9 and 10 differentially and the other is the asymmetrical input where Pin 9 is grounded via a capacitor and the signal is input to Pin 10.
Pins 4 and 5 are the mixer outputs. Pins 4 and 5 are open collectors, so the power must be supplied externally. The electric potential of Pins 4 and 5 at this time must be DC 4.0 V or more.

IF amplifier circuit

The signals frequency converted by the mixer are output from Pins 4 and 5, and then they are input to the IF input Pins 1 and 2 via the external tuned circuit. As the IF tuned circuit, the single-tuned circuit shown in the Electrical Characteristics Measurement Circuit or double-tuned circuits can be connected. When used as the single-tuned filter, be sure to connect it via the capacitor so that the DC voltage may not be applied to Pins 1 and 2.
The signal amplified by the IF amplifier is output with symmetrical or asymmetrical output format. Selecting symmetrical or asymmetrical is performed at Pin 7. Asymmetrical output when Pin 7 is grounded via the capacitor; symmetrical output when it is directly grounded. During symmetrical output, SAW filter direct connection is possible and during asymmetrical output. During asymmetrical output, output is performed from Pin 20, and during symmetrical output, output is performed from Pins 19 and 20. The output impedance is approximately 30 Ω.

U/V switch circuit

UHF operation is chosen by applying voltage of 3 V or more to Pin 18, VHF operation for 0 V or open.

Notes on Operation

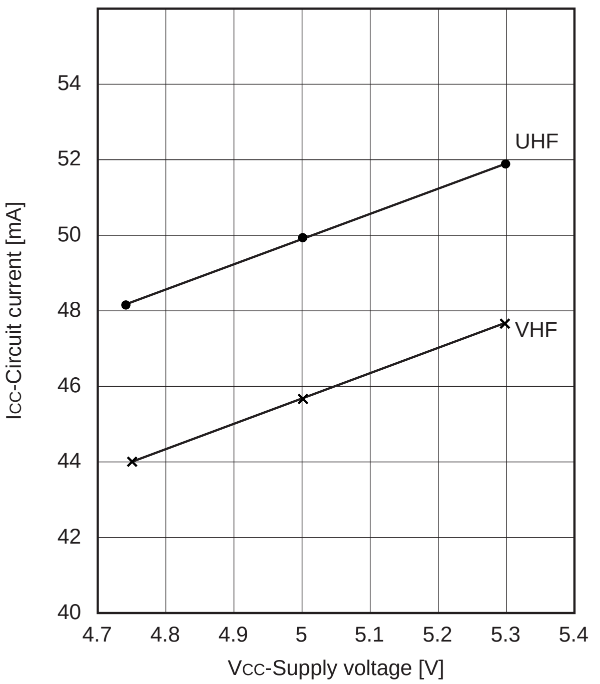
1. Care should be taken for grounding, etc. when placing external parts as the operating frequencies are high.

2. Be sure to design the printed circuit board considering the radiation of heat by placing the GND pattern at the bottom of the IC.

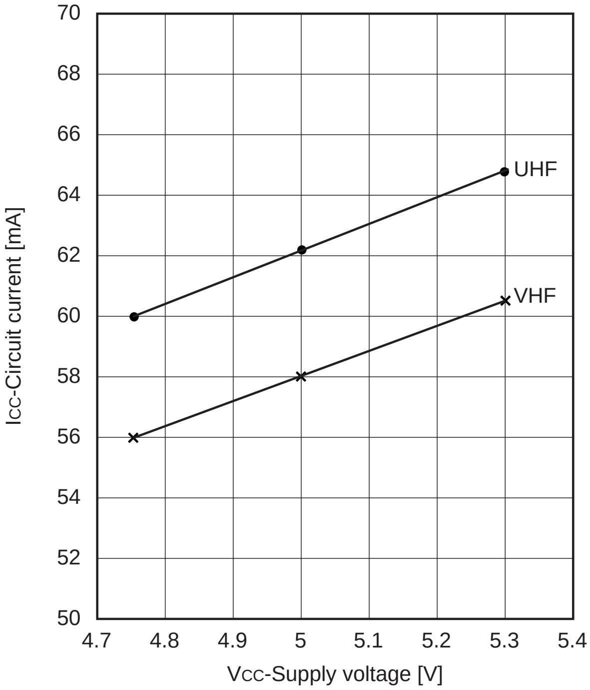
3. Care should also be taken to prevent electrostatic damage because of using high frequency process.

Example of Representative Characteristics

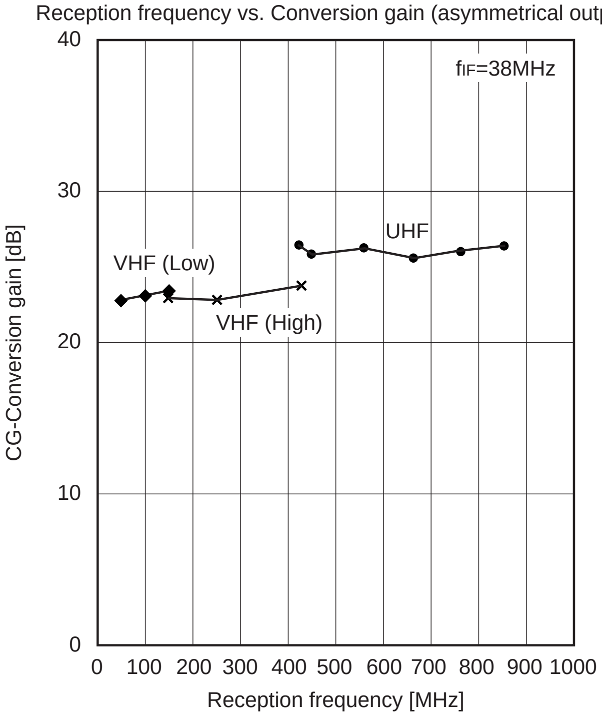
Supply voltage vs. Circuit current (asymmetrical output)



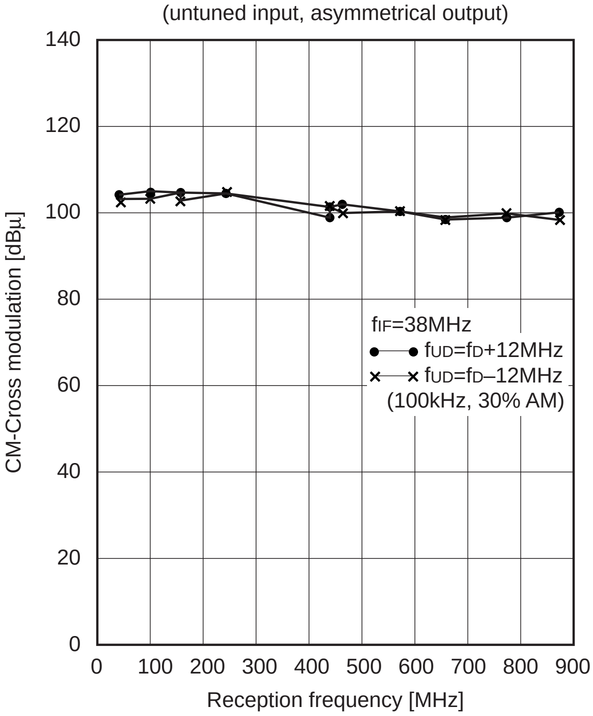
Supply voltage vs. Circuit current (symmetrical output)

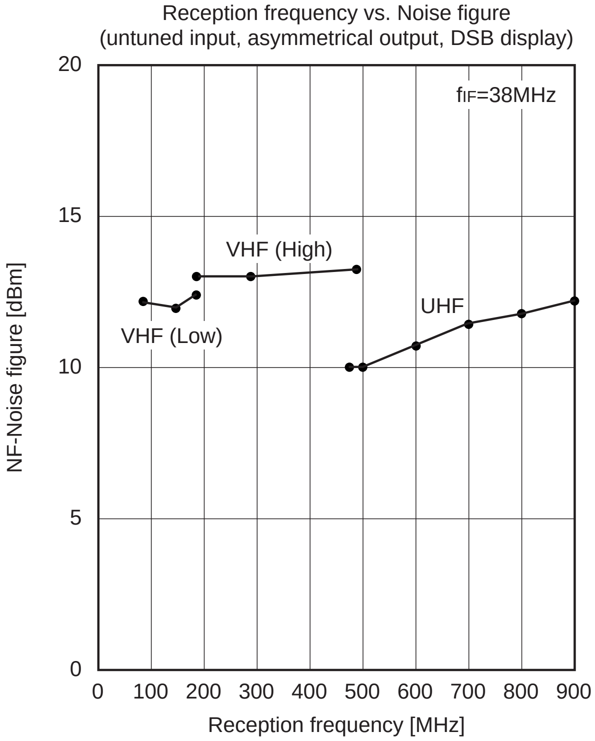


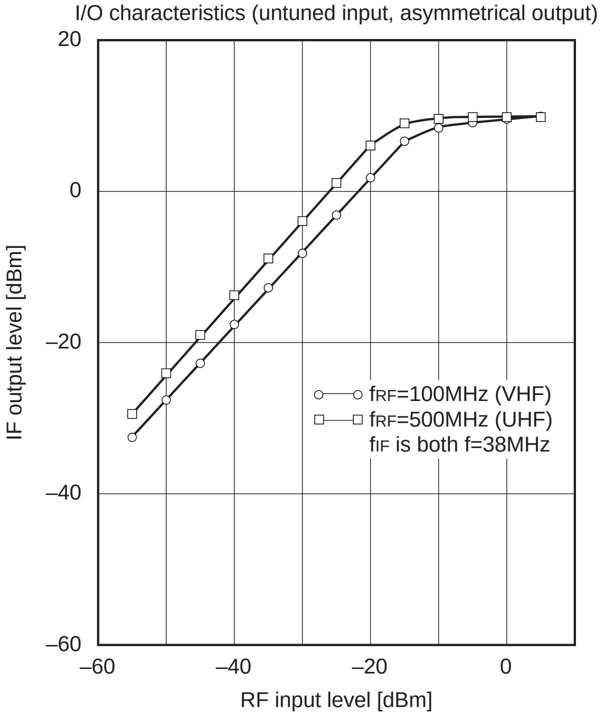
Reception frequency vs. Conversion gain (asymmetrical output)

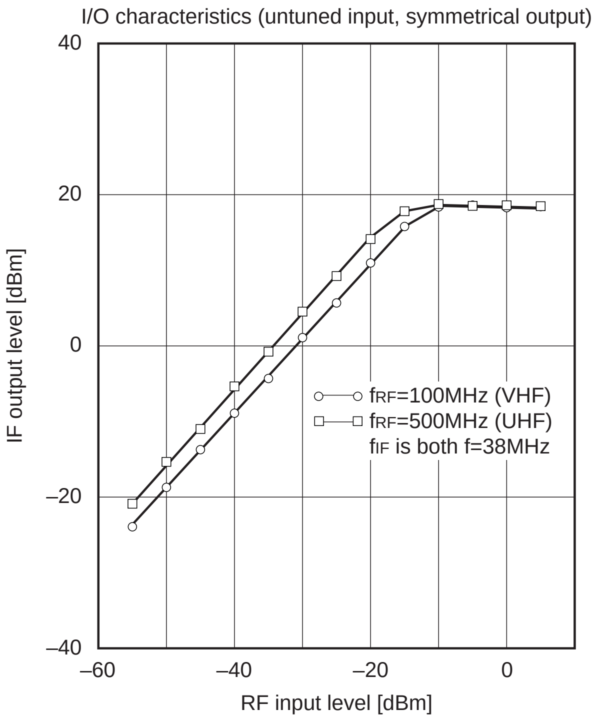


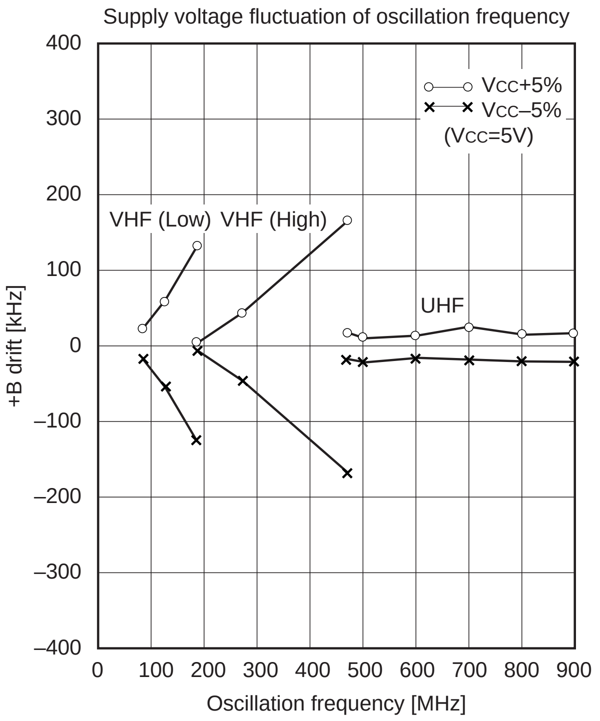
Reception frequency vs. Next adjacent cross modulation
(untuned input, asymmetrical output)



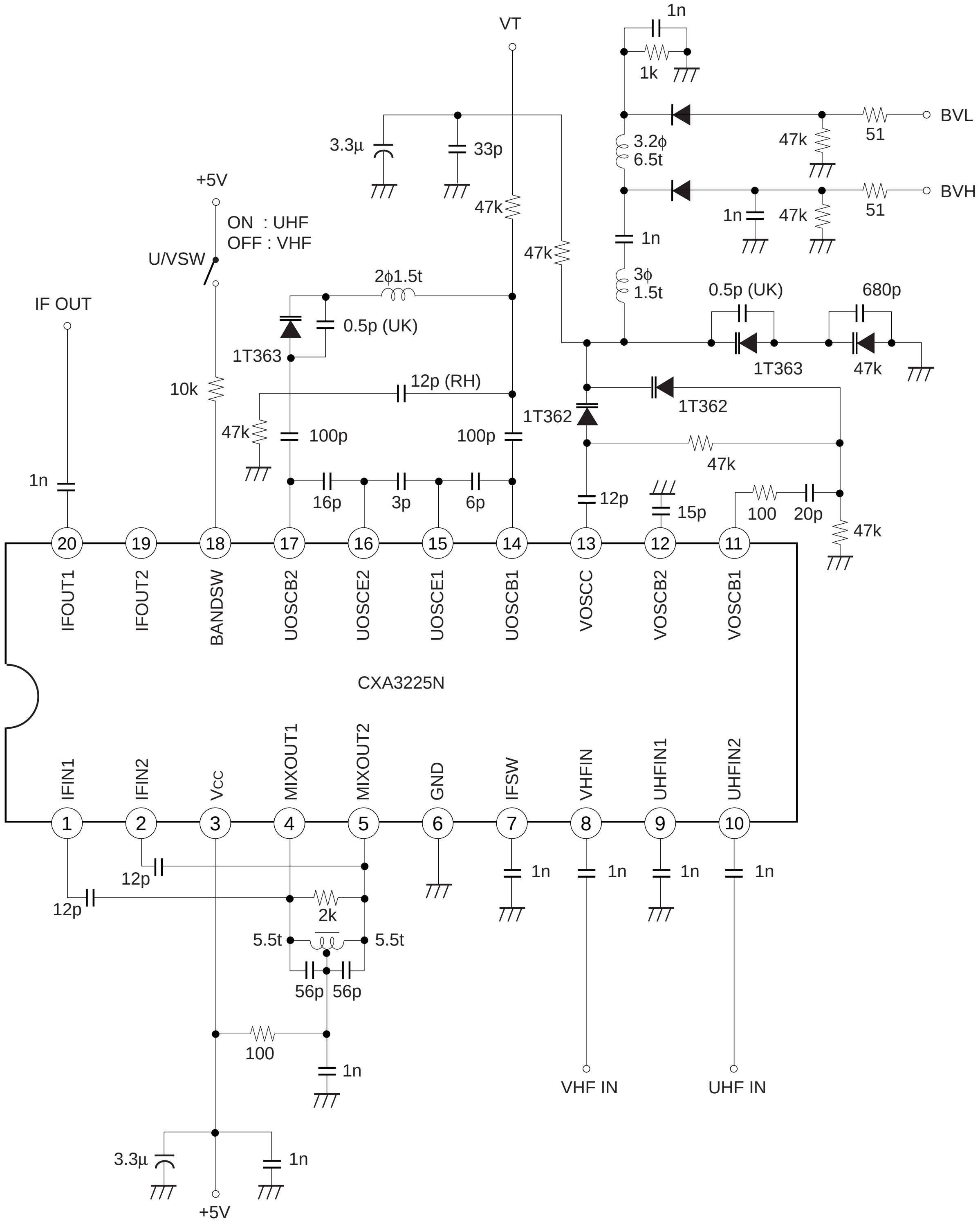

Reception frequency vs. Noise figure
(untuned input, asymmetrical output, DSB display)
fIF=38MHz
VHF (High)
VHF (Low)
UHF
NF-Noise figure [dBm]
Reception frequency [MHz]
20
15
10
5
0
0 100 200 300 400 500 600 700 800 900


I/O characteristics (untuned input, asymmetrical output)
fRF=100MHz (VHF)
fRF=500MHz (UHF)
fIF is both f=38MHz
IF output level [dBm]
RF input level [dBm]
20
0
–20
–40
–60
–60 –40 –20 0

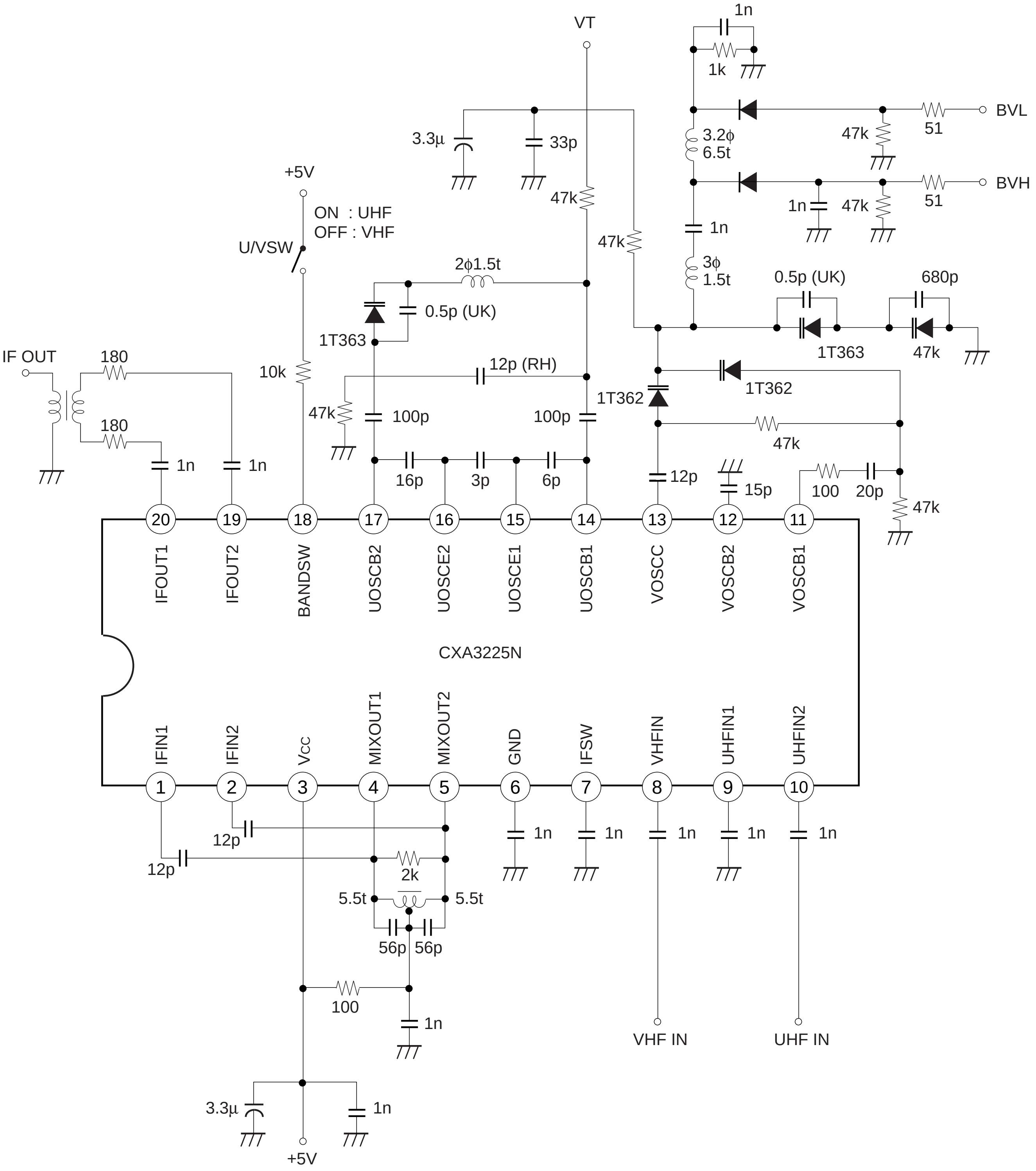

I/O characteristics (untuned input, symmetrical output)
fRF=100MHz (VHF)
fRF=500MHz (UHF)
fIF is both f=38MHz
IF output level [dBm]
RF input level [dBm]
40
20
0
–20
–40
–60 –40 –20 0


Supply voltage fluctuation of oscillation frequency
VCC+5%
VCC–5%
(VCC=5V)
VHF (Low)
VHF (High)
UHF
+B drift [kHz]
Oscillation frequency [MHz]
400
300
200
100
0
–100
–200
–300
–400
0 100 200 300 400 500 600 700 800 900

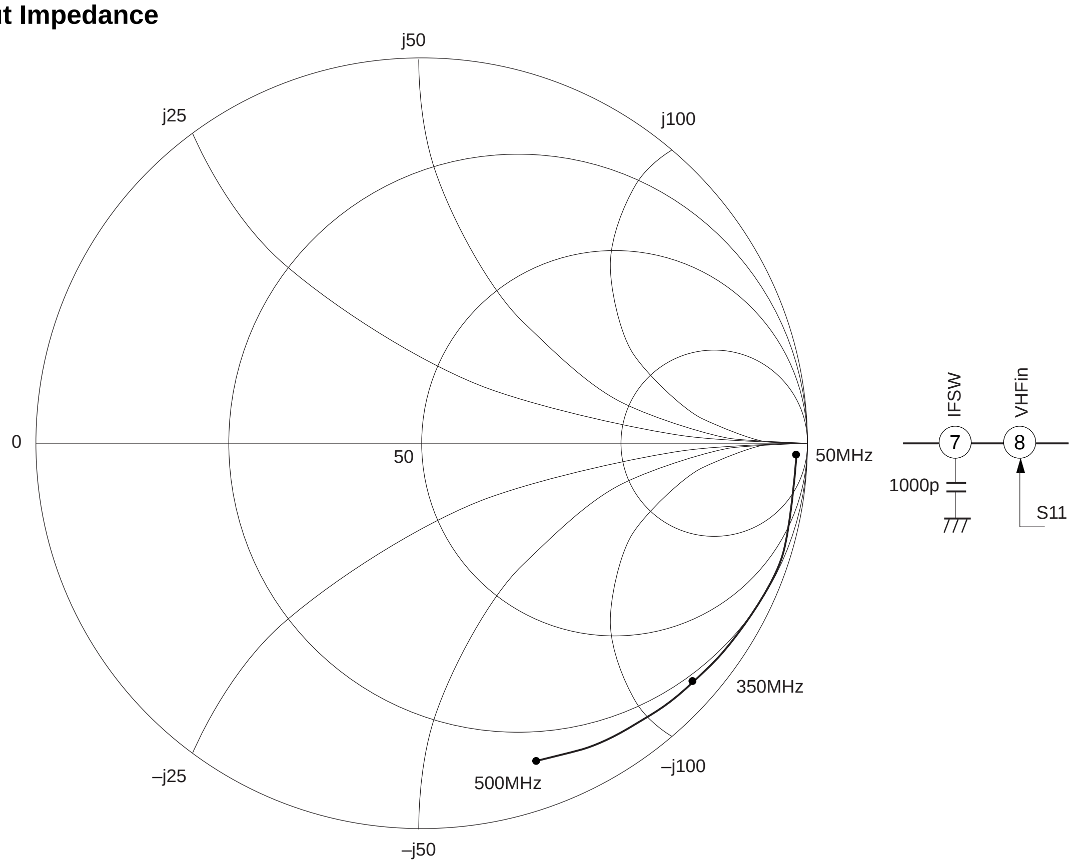
Electrical Characteristics Measurement Circuit (asymmetrical output)



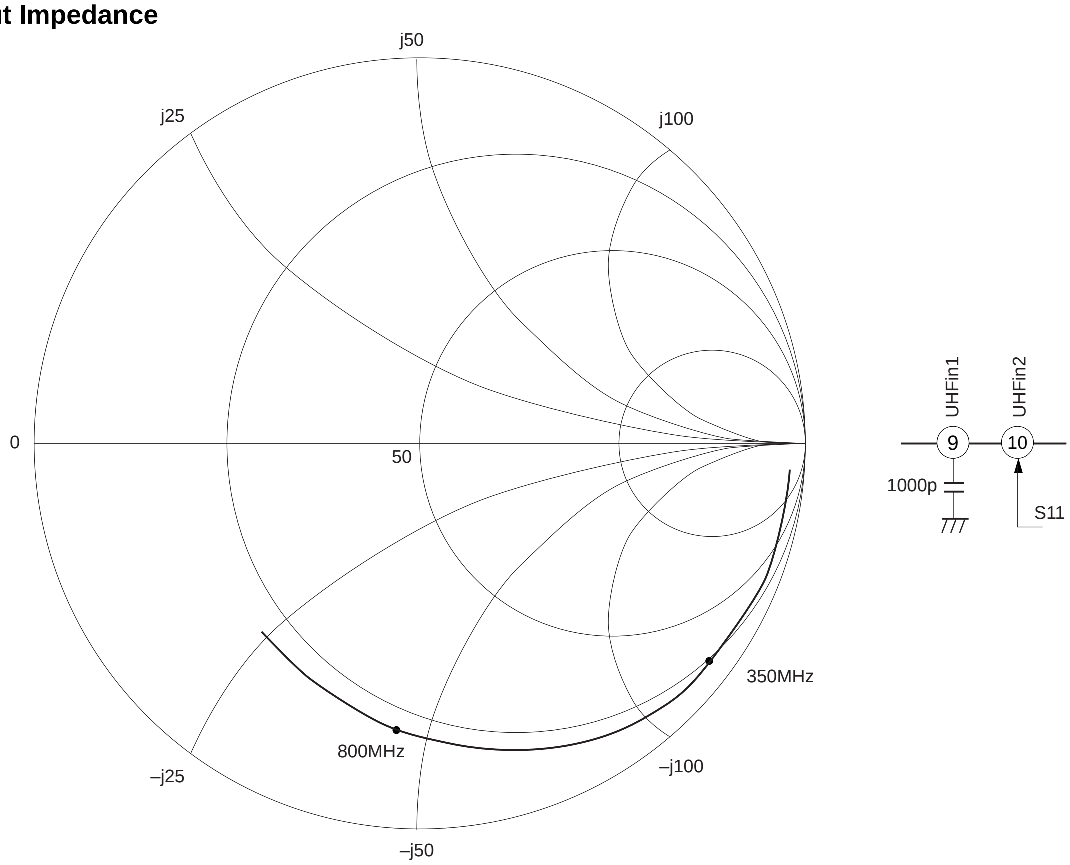
Electrical Characteristics Measurement Circuit (symmetrical output)



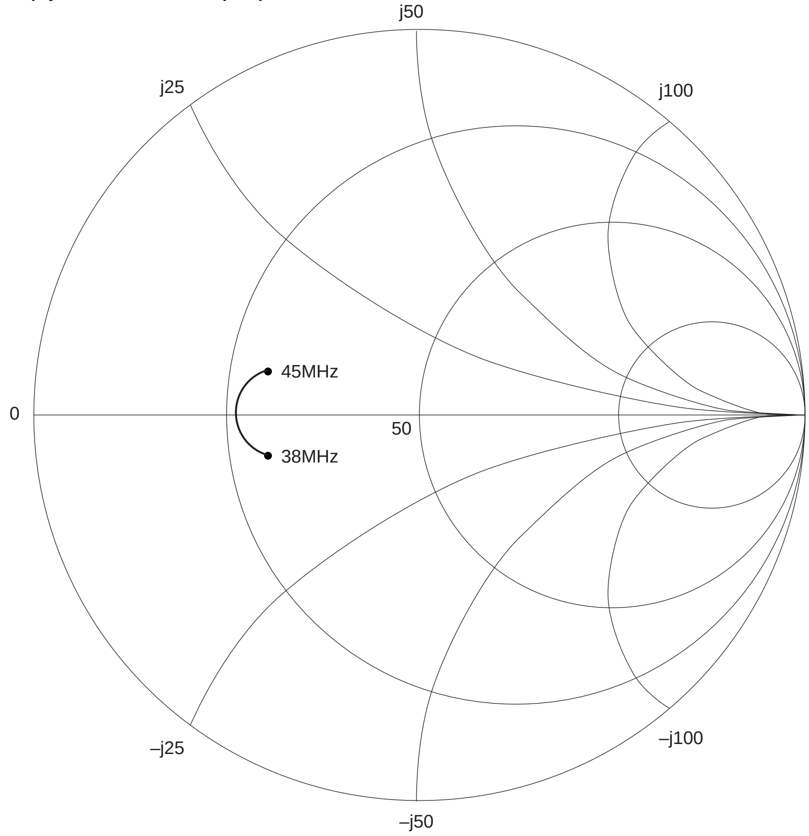
VHF Input Impedance



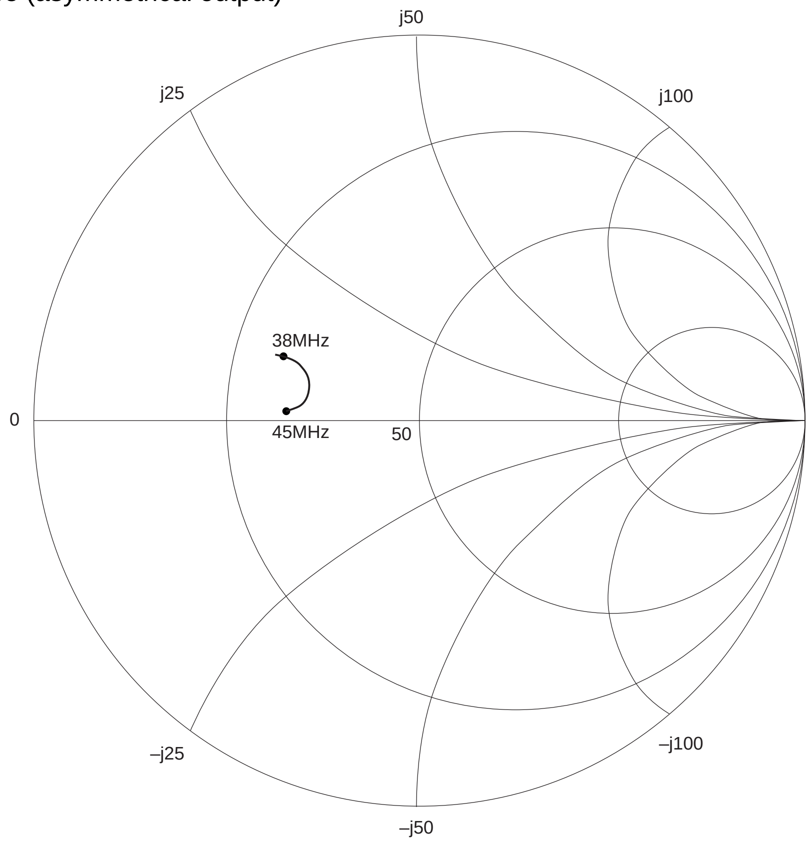
UHF Input Impedance



IF Output Impedance (symmetrical output)

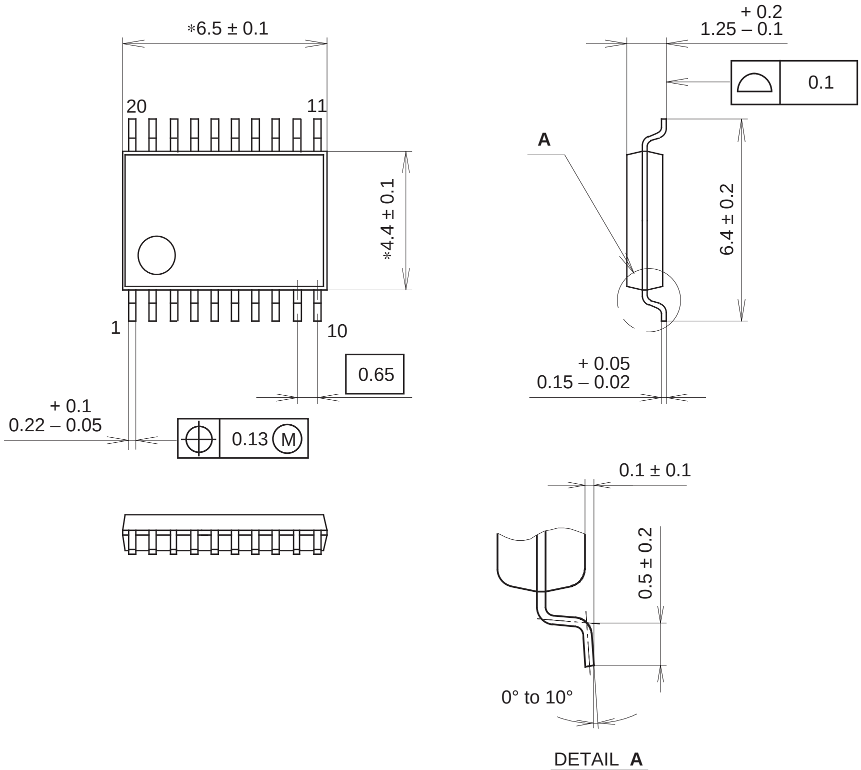


IF Output Impedance (asymmetrical output)



Package Outline Unit : mm

20PIN SSOP (PLASTIC)



NOTE: Dimension "*" does not include mold protrusion.

PACKAGE STRUCTURE

SONY CODE	SSOP-20P-L01
EIAJ CODE	SSOP020-P-0044
JEDEC CODE	————

PACKAGE MATERIAL	EPOXY RESIN
LEAD TREATMENT	SOLDER / PALLADIUM PLATING
LEAD MATERIAL	42/COPPER ALLOY
PACKAGE MASS	0.1g

NOTE : PALLADIUM PLATING
This product uses S-PdPPF (Sony Spec.-Palladium Pre-Plated Lead Frame).